THEORY AND PRACTICE IN GLOBAL WAREHOUSE LOGISTICS ACTIVITY

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Veronica BULAT, ORCID: 0000-0002-6051-3460
Moldova State University
Roberto GALANTI
University Sancti Cyrilly, Malta

Abstract: *Logistics is the management of materials, production processes and the physical distribution of products in the control of the entire operational cycle of the company expressed both in the form of physical flow and information flow, with the participation of both internal and external actors, who are part of a single supply chain. The goal is to control performance with quantitative and qualitative methods to ensure a high level of customer service, providing products quickly, at low cost and of high quality. The methods used by logistics have the characteristic of guaranteeing an adequate level of integration and flexibility of activities and processes; it is thanks to an efficient collaboration between all the management areas of the system that the company can achieve what it has set itself. In this brief introduction we have seen how logistics is a complex discipline, full of facets and with vast arguments; given the extent of the subject, it is impossible to consider every single aspect and every single part 10 that make it up, so it was decided to treat the aspect that is most physically controllable: the warehouse area. Storage activities, in fact, can be defined as the real beating heart of the whole organization. From the warehouse, the products are prepared and shipped, the main data are obtained which indicate the company's performance and establish the quantities to be produced and the materials to be ordered; in the warehouse the goods are temporarily deposited.*

Key words: *warehouse, global economy, deposits, logistics, cost optimization, supply chain management.*

Introduction

Each industrial and commercial company dedicates a special space for the containment of raw materials, semi-finished and finished products: the warehouse. It is the place where orders and shipments are managed, strictly connected to the production activities and the receipt of the products themselves; it is one of the primary sources of physical and information flows. However, the warehouse should not be seen uniquely as a place to store goods, but as a well-balanced system of people, infrastructures, technologies and vehicles [1]. For these reasons, warehouses deserve an in-depth study that allows us to investigate the organization, management and processing of the data and information that are generated and flowing into this place. It is important to keep in mind that warehouses can have different sizes, depending on of the company activities, of the volumes produced and handled, of the stocks of goods and therefore of the company strategy adopted (the most common are Make to Stock, Make to Order, Assembly to Order). Important aspects concerning warehouses will be examined below: benefits and costs, the different types according to the classification method, the way in which the goods are stored, the design criteria, the valuation indexes and the product withdrawal models.

Results and discussion

The main objective of the storage activity is to satisfy the customer by minimizing the costs for the company, keeping the right quantities of products (to promptly respond to customer requests), in the most appropriate place for both management than for the size [4]. According to the Toyota Production System, the virtuous company is the one that is able to manage its business by zeroing stocks; this consideration, purely theoretical, indicates how it is necessary to keep the level of stocks under control and reduce it to a minimum [3]. Despite this, there are several reasons why the company finds benefits in having a warehouse: first of all, it allows you to manage the unpredictability of events that often cause production blocks or customer dissatisfaction due to delivery delays; secondly, it allows for the management of fluctuations in demand due to seasonality, trends or causes that are not easily identifiable and therefore not manageable, making it possible to cope with sudden requests, therefore dampening irregularities; protects the company from suppliers who do not respect delivery dates and allows you to manage the procurement of

those rare or hard to find raw materials / products; protects against fluctuations in the price of products; finally, it allows you to purchase larger quantities of goods and thus take advantage of quantity discounts [2]. Food companies of seasonal products, such as the one analyzed in this text, are particularly affected by fluctuations in demand and prices, as well as the unreliability of suppliers of sought after and not very widespread products, here is that the warehouse allows to cushion the possible negative effects of these issues.

The objective of minimizing operating costs implies that an accurate and always careful management of the following cost items is implemented:

- Economic costs: these are those that arise from the immobilization of capital;
- Reception activities: the operators assigned to the tasks of storage take care of stocking, picking, packing, shipping;
-Surface: each square meter of occupied surface represents a cost in terms of maintenance and infrastructure (depreciation, energy, taxes, etc.);
- Loss of value: the value of the goods in stock may vary over time, because it is subject to deterioration, obsolescence, damage, theft. To determine the fixed asset value of the goods, the literature proposes different calculation methods:
- FIFO (First in First Out) method: the first product that arrives in the warehouse is the first to be sold. The company that adopts this logic produces and sells perishable products or products subject to obsolescence;
- LIFO method (Last in First Out): the last product that arrives in the warehouse is the first to be sold. The products for which this second is adopted alternative are not obsolescent and therefore are not excessively affected by the passage of time;
-Average value: in this case the average value of the remaining items is calculated, considering the inventory;
-A current value: it is assumed that at the date of the survey the commercial value of the item has increased since the date of storage.

There are several criteria that allow classifying the different types of warehouse:

1. Categories of units to be stored: loading units (UoC), packages, special materials;
2. Automation level: manual, semi-automatic, fully automatic;
3. State of the material: raw material, semi-finished or semi-assembled, finished product The term load unit (also called tertiary packaging) refers to containers of various shapes and materials, loaded with products destined for the warehouse, for handling and shipping.

These can be wooden or plastic pallets (in the various forms of the Euro pallet EPAL 800x1200 to the "Philips" 1000x1200 or the square plan), metal cages with or without wheels, plastic or metal boxes, metal baskets. A common feature is collapsibility, is the ability to occupy a small space when the load unit is empty, thanks to the geometry designed to make it removable or stackable. The storage of the load units can provide for the overlapping of the same for light materials that are not likely to be damaged, or the presence of shelving in the event that the shape, weight or picking strategies require it. Items that cannot be grouped into load units due to the variety or nature, method or frequency of handling, are placed in the warehouse inside packages, is cardboard or thermoplastic boxes; these can be arranged in stacks without the need for supporting structures or in shelves served by humans or by means of transport such as conveyors.



Figure 1. Types of pallets, metal and thermoplastic boxes



Figure 2. Packages for storage in various sizes.

The manual warehouses for loading units have a distinct subdivision of different functional areas:

- Goods reception and acceptance area, where raw materials and incoming products are unloaded, accompanied by the Transport Document (DDT) which contains the details of the transported material. During the unloading phase, a first quick check takes place which allows to verify that the delivery is correct;

-Quality control area, in which a representative sample of the goods is checked with greater accuracy: if the products meet the specifications they are stored and will go into production, otherwise they are placed in a special shelving to be returned to the supplier by activating the procedure of non-conformity of the goods;

-Storage area, which is the main area in which the material is placed, with or without shelving, where the inventory is made and the inventory of the goods is checked, comparing it with the computer data present in the company. Shipments of entire load units of the same code and lot can start from this area;

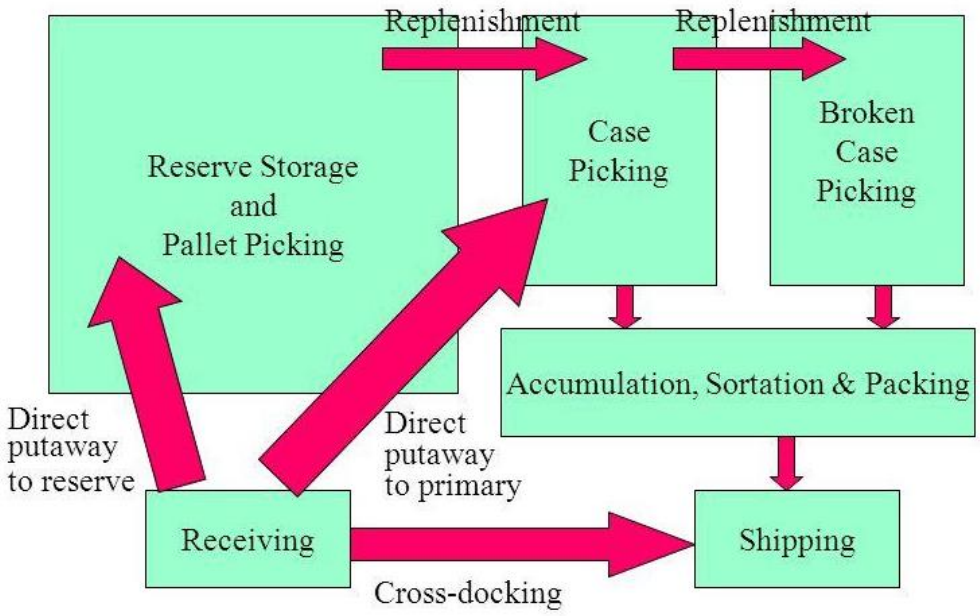


Figure 3. Circulation of material flow in warehouse

- Picking area, is the term used to indicate the area intended for the fractional picking of individual packages. This area is fed by the storage area with the entire load units; when the customer's order is confirmed, the warehouse worker, equipped with the corresponding picking list, starts his picking mission from the various single-product loading units. The picking activity is always associated with that of refilling, ie the restoration / replenishment of the loading units where the picking took place;

- Packaging and shipping area: this is the space dedicated to the weighting, filming and labeling of the pallet. Once the pallet is ready, the transport documentation is drawn up here and the goods are sent to the recipient of the goods via the loading docks.

Table 1: Advantages and disadvantages of systems of storage

SYSTEMS OF STORAGE	ADVANTAGES	DISADVANTAGES
Stack	No investment in infrastructure; High surface yield.	Reduced selectivity; Not suitable for obsolete products; Limited capacity for height optimization.
Static shelving warehouse	Maximum selectivity; Low investment; Maximum customization.	Each shelving needs an access corridor; Not high surface and volumetric yields.
Warehouse drive-in	High storage density; Possibility of managing FIFO logic.	Not suitable for a high number of references; Reduced selectivity.
Dynamic gravity warehouse and dynamic flow-rail	High storage density; Ability to manage FIFO logic; Greater safety in operations; Less time for collection.	Higher costs than the drive in; Not suitable for a high number of references; Reduced selectivity.
Dynamic compactable warehouse	Excellent volumetric efficiency; Standard handling equipment.	Low selectivity; Long access times to unavailable goods; Pick-up mission schedules.
Dynamic warehouse with stacker lift	Very high selectivity; High process speed; High optimization of space and picking activities.	High investments; Suitable for products that are homogeneous in shape and size.

Study case: AVANZINI transports

Avanzini is a company that has been operating in the field of road transport since the beginning of the last century. Avanzini was registered in Valeggio Sul Mincio and then moved to Nogarole Rocca, in Via del Lavoro 1, where it operates as a national and international forwarder. In 2009, the logistics platform of Valese di Oppeano was opened, a new 19,000 m2 building. Inventory management mainly answers 2 questions, namely when to place the order and how big it should be. To do this there are obviously several possible methods, traditional methods such as threshold management, periodic review management or more modern methods (just-in-time, Kanban, etc.).

SWOT analysis of Avanzini transports, as instrument, is considered a powerful support for decision-making because it enables an organization to uncover opportunities for success that were previously unarticulated. It also highlights threats before they become overly burdensome.

Strong points

- special research department,
- well-done tradition of the company,
- own patented technology,
- corporate spirit,
- recognized specialists among employees,
- well-known brand, products and services,
- good reputation among customers,
- low product costs,
- available capabilities for products that are sought after,
- good distribution networks,

• each product has a target market,
• the company is not dependent on a customer or group of customers.

Opportunities

• increasing the demand for the company's products
• new technologies,
• the possibility to expand the company in other areas,
• The company could buy other smaller companies in the market,
• new markets,
• permissive legal regulations,
• progress,
• the existing legislative framework for the development of quality management.

Weaknesses

• organizational deficiencies,
• lack of involvement of the employed staff,
• minimum communications between departments,
• staff turnover,
• the decrease in the number of sales agents led to a decrease in turnover.

Threats

• restrictive regulations,
• unstable political / economic environment,
• possible new trade barriers,
• unfair competition,
• strong local competition coming.

The dimensioning of the trolley fleet requires in the initial phase the definition of the position of the loading and unloading stations and the network of routes with the relative possible directions. Once the total distances to be covered have been determined, not only for full load travel but also for empty journeys to balance the system, it is possible to determine the sufficient number of trolleys for transport activities. In the final phase, the dynamic behavior of the system designed to be able to eliminate any problems in the routes and at the intersection of the vehicles occurs.

Starting from the detailed CAD plan, the loading / unloading nodes are identified. Once these points of interest have been identified, the routes between them are shown, indicating the directions of travel. It is essential to know the matrix from material flows, looking for the most critical situations in terms of days (*Ttr*) in which, compared to historical data (*Tpr*), the load working conditions and conditions have been more unfavorable.

$$Ttr = \sum\sum nij \cdot tijNj = 1ni = 1$$

With:

- nij number of journeys from station *i* to station *j*;
- tij total journey time from station *i* to station *j* including loading and unloading times of the goods.

$$Tpr = \sum\sum xij \cdot tijNj = 1ni = 1$$

With:

- xij number of empty trips from station *i* to station *j;*
- tij total travel time from station *i* to station *j*.

The sum of the times at full load and at empty allows to obtain the total time. The purpose of sizing is to obtain a sufficient number of trolleys, minimizing the number of empty trips, activity that does not add and therefore should be reduced as much as possible. To minimize empty trips, the net flow of cars for each station is determined, which for the *i*-th station is:

$$NF\ (i) = -\sum nij + \sum nij + fi - giji$$

With:

- *nij* number of journeys from station *i* to station *j*;
- *fi* any vehicles available in station *i*;
- *gi* any vehicles required at station *i.*

We want to obtain that $\sum N(i) = 0$, therefore the vehicles are placed in an optimal way so that those redundant in station *i* can satisfy the need for other stations. Knowing the equation for determining the total travel time of unloaded vehicles along the routes, the values of the variables xij which minimize this time are sought, considering the following constraints:

The solution obtained is not always unique, there are often several possibilities to balance the journeys with load and without load, while minimizing the times of the empty sections, linear programming, inserting the objective function and the constraints already defined previously.

In Avanzini trasports there is a fleet of various types of vehicles both for the handling of the pallets, by means of trans-pallets, and for the positioning and collection of goods on shelving with front trucks. The number of vehicles, equal to 18, has so far been sufficient to meet the needs; with the recent expansion and the projects started, the distances to be covered and the heights to be served have increased, therefore the trolleys currently supplied are not sufficiently fast and performing. The choice of the company is to renew itself in this area to, scrapping the oldest and least used trolleys and investing in faster means. To calculate the optimal number of trolleys for the transport of goods, the method described above is used; starting from the map on which the routes have been indicated, knowing the distances between the loading / unloading points and obtaining the data on the Load Units handled from the management software, it is possible to create the matrices of the length of the sections from-to and of the flow of pallets.

Conclusions

The aim was to „touch" the characteristics of a company, its structure, organization methods and subdivision of the different activities and the types of relationship existing between the different sectors of it.

Avanzini transports should invest in information technologies because they are not efficient enough to satisfy the workload. The program in which it works creates problems very often and due to this it stops absolutely everything in the warehouse. The exchange with another more efficient program would change the situation for the better. The investment is great given in the long run.

Another important factor, we would invest in, are workers who do not do internships when they come to work because they try to save on staff costs. This is where many errors occur in customs documents and damage to goods.

We would mention that the company is quite well managed because free space doesn't exist, this means that the maximum load for maximum profit. The company manages many clients and offers cross-docking services.

Bibliography:

1. Bowersox D. Closs D., Kooper M. (2019) *Supply Chain Logistics Management*. Michigan: McGraw-Hill
2. Krilatkov P.P. (2016) *Logistika promishlenovo predpreiatia.* Industrial enterprise logistics, Ekaterinburg: Ural.
3. Shumaev V. A. (2016) *Osnovi logisiki.* Basics of logistics, Moscow: Law Institute MIIT.
4. Levkin G. G (2009) *Logistika: teoria i praktika.* Logistics: theory and practice, Rostov-on-Don: Fenix.